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SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN that I, Carlos A. Torres, have invented new and useful improvements in

SYSTEM, METHOD AND APPARATUS FOR SECURING CONTROL LINES TO A WELL PIPE

of which the following is a specification:

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By:_____
Cathy Hayes

System, Method and Apparatus for Securing Control Lines to a Well Pipe

Field of the Invention

The present invention relates to the construction of wells used to convey minerals to the surface of the earth from a subsurface location. More particularly, the present invention relates to an apparatus, system and method for securing power, control and/or injection lines to the pipe that is installed in wells to convey oil and gas and other minerals between the subsurface location and the well surface.

Prior Art Setting of the Invention

Oil and gas and other minerals produced by wells drilled into the earth are conveyed through the well to the well surface by a pipe string frequently referred to as a "production string". Some wells, particularly those in offshore water locations, employ lines secured along the external length of the production string to monitor, regulate and stimulate the flow of the petroleum fluids through the string. The control lines may be conduits that contain a pressurized fluid that is used to regulate the opening or closing of subsurface valves and other controls connected with the production string. Control lines may also be electrical conductors that are used to communicate power and information between subsurface equipment and the well surface. Control lines may be power lines, attached to the external surface of pipe strings, that are used to power submersible electric pumps. The control lines may also be injection lines that provide a conduit for injecting treating fluids, solvents and other chemicals into the well formation and/or into the fluids to be produced from the well.

The control lines are often covered with a protective plastic coating and may be assembled in bundles of two or more lines referred to as "flat packs". Such lines, whether coated or uncoated, and whether single or bundled with other lines, as well as other lines ancillary to the production of the well fluids, are herein referred to, inclusively, as "control lines".

Control lines are clamped or otherwise secured to the production tubing string as the tubing string is being assembled and lowered into the well. The control lines can be

damaged during installation of the tubing if the control lines are caught between the string and the pipe holding or pipe support equipment used to suspend the tubing string from the rig floor.

The pipe support equipment is designed to engage and hold the pipe by either frictional contact with the pipe body or by providing a mechanical support device below a coupling or upset or other radial projection on the string. The pipe holding equipment, which usually rests on or in a rig floor, is "set" to contact the external surface of the tubing string to support the string. The mechanical support type device is often a tightly fitting collar positioned below the radial projection provided by a coupling.

"Pipe slips" are a common pipe support mechanism used to hold the pipe from the rig floor through fractional contact. The pipe slips are typically constructed in several tapered, wedge-shaped slip segments that are configured to be received within a frustro-conical bowl positioned in, or upon, the rig floor. The floor mounted pipe support mechanism containing the slip segments is often referred to as a "spider".

Setting the slips about the pipe to suspend the pipe string from the rig floor requires that the slip segments be lowered axially into the bowl, forcing the segments radially inwardly against the pipe string. The slip segments are provided with slip dies having a pipe contact surface that produces a sufficiently high coefficient of friction between the segments and the pipe to wedge the string in the bowl. In operation, the weight of the pipe string acts through the frictional contact surface with the dies to pull the slip segments down into the conical bowl, increasing a radially directed pipe holding force exerted by the slip segments against the pipe to prevent the string from moving further downwardly through the bowl.

A conventional procedure for clamping control lines onto a production pipe string requires that the control lines, which extend through the spider alongside the pipe, be manipulated away from the contact area between the slip dies and the external surface of the pipe when the slips are being set. Once the slips have been set, additional pipe segments (joints) are added to the production string. A movable overhead pipe support, which may be a traveling block or top drive or the tool carried by such assemblies herein referred to generally as an "elevator" then takes over the support of the string and the

spider slips are then retracted away from the production pipe string. The control lines are then manipulated against the production pipe string where they are clamped to the pipe string with a clamp that typically encircles the control lines and a coupling joining two sections of the pipe string. Once the clamp is applied, the clamped control line and pipe string are lowered through the rig floor until the top of the string is at personnel working height above the floor. The control lines are again manipulated out of the way and the slips are set. The described procedure is repeated until the desired length of pipe string has been installed in the well. Each time the sequence is repeated, the control lines are exposed to crimping or other mechanical damage caused by opening or setting the slips.

While damage may occur in many ways, it is estimated that the most common cause of control line damage is caused by accidentally setting the slips while the control line is inadvertently positioned between the pipe and the slip dies. This type accident can also occur when there is a miscommunication between the person responsible for manipulating the control line away from the contact area between the pipe and the unset slips and the person controlling setting of the slips.

Another opportunity for damage results from the fact the control lines, which may be extremely stiff and difficult to maneuver, can be very difficult to manually hold in position. If the control lines spring away from a protected position into a pinch area of the setting slips, they will be cut or otherwise damaged as the slips close.

Conventional installation of control lines requires coordination of activity and communication between at least two people to properly position the control line and set the slips in a manner that precludes control line damage. Even where communication and activity are coordinated, the control lever that regulates closing of the slips may be inadvertently moved due to equipment malfunction or other error before the control line has been properly positioned within the slip assembly. The possibility for damaging the control lines exists any time the control lines and the movable parts of the slip assemblies are physically able to engage each other.

Prior art techniques that manipulate the control line through the relatively small gaps formed between segments in the slips assembly require that the control lines be limited in cross sectional dimensions and that they approach the slip assembly in a

direction coinciding with a gap between the slip segments. Access to the slip assemblies imposed by the gap orientation and size can be problematic when a large number of lines or large diameter lines must be accommodated in the slips segment gaps.

Some prior art procedures use pipe holding devices with built-in control line receiving recesses. One such procedure uses one pipe opening of a dual slip bowl to hold the control lines while the second opening holds the pipe. Any structure separating the two bowls must be removed each time a line is clamped against the pipe. Control line access is restricted in such systems to one side of the pipe, similarly to those systems employing a single set of conventional slips.

Damage to the control lines can require a time-consuming, costly field repair or, even more undesirable, can require that the pipe string be withdrawn from the well and rerun with replacement control lines. These repair procedures can be extremely expensive, particularly in the environment of deep-water offshore well completions where rig costs can exceed $250,000 per day.

U.S. Patent No. 6,131,664, assigned to the owner of the present invention, describes a system, apparatus and method for installing control lines in a well that preclude the possibility of damage to the control lines during installation of a pipe string. The invention of the patent provides for elevating the slips and the personnel that assemble the pipe to a position above the rig floor to permit the control lines to be secured to the pipe string below the elevated slips. The control lines may thus be supplied to the pipe string without first passing through the slips holding the pipe. Because the control lines do not extend through the slips used to support the pipe string, the possibility of slip-caused damage is completely eliminated. In this prior art procedure, the slip assembly used to support the pipe and the equipment used to handle the control lines never simultaneously occupy the same physical space.
When the installation procedure is such that the control lines and the pipe support slips may simultaneously occupy the same physical space, the control lines are at risk of being crimped or otherwise damaged each time the slips are set against the pipe.

Brief Summary of the Invention

Control lines extend vertically through lateral spaces found between a rig floor and a pipe holding assembly supported on the rig floor. The pipe holding assembly is raised off of the floor by the traveling block or top drive ("elevator") to allow the control lines to be clamped to the pipe below the pipe holding assembly.

In one method of the invention, after a joint of pipe is screwed into the coupling at the top of the string, the string weight is taken by the rig elevator and the floor mounted pipe holder (spider) is opened to permit the newly added joint to be lowered into the well. Control lines connected to the outside of the string, extend to supply reels on the rig floor through the lateral openings between the pipe holder and the floor, and are fed into the well alongside the lowering pipe string. When the elevator has been lowered to personnel work height above the spider, the spider is attached to the elevator. The elevator direction is then reversed to lift the spider off the floor and to raise the attached string and spider until the coupling that received the newly added joint is at a convenient working height above the rig floor. Rig floor personnel apply a clamp around the coupling to secure the control lines to the pipe string. The spider is then lowered back to rest on the floor where it is activated to support the string. The elevator releases the string and the spider and is elevated into the derrick in preparation to the addition of more pipe to the string. Another joint of pipe is screwed into the coupling at the top of the string and the previously described process is repeated until the entire string with attached control lines has been lowered into the well.

The present invention permits the control lines to be secured to the outside of the production tubing without exposure to crimping or damage caused by closing pipe slips.

The present invention allows rig floor access for applying a clamp to a pipe coupling without requiring that the clamp subsequently pass through the pipe holding equipment.

The system, method and apparatus of the present invention allow a control line to extend directly from a supply reel to a string of well pipe being run into a well without first passing through the pipe holding device used to support the pipe string.

Another advantage of the present invention is that one or more control lines can be secured to a pipe string with a clamp that is larger than can be passed through the central opening of the pipe holding device.

Yet another feature of the present invention is that the control lines may be clamped to a pipe string while the rig floor is free of control line handling equipment in the area adjacent the rig floor opening.

An important feature of the present invention is that the control lines may be safely installed without the need for elaborate and expensive control line running equipment that must be positioned over the floor opening or above the rig floor.

The present invention permits the installation of control lines against a pipe string without any danger of slip-caused damage and without need to extensively modify the pipe handling equipment used to run and support the pipe string.

The system, method and apparatus of the present invention permit the safe and efficient clamping of control lines to a pipe string without requiring that personnel be elevated above the rig floor.

The foregoing features, objectives and advantages of the present invention, as well as others, will be better understood and more fully appreciated by reference to the following drawings, specification and claims.

Brief Description of the Drawings

Figure 1 is a vertical elevation, partially in section, illustrating an offshore well being completed with a control line clamped to the outside of a pipe string;

Figure 2 is a detailed vertical elevation, partially in section illustrating a prior art process in which a control line is clamped to a pipe string being lowered into a well from a drilling rig floor;

Figure 3 is a vertical elevation, partially in cross section, illustrating a prior art slip assembly supporting a pipe string with a control line extending through the set slip assembly;

Figure 4 is a plan view, partially in section, taken along the line 4-4 of Figure 3;

Figure 5 is a vertical elevation, partially in cross section, illustrating the prior art slip assembly of Figure 3 with a control line at risk of being crimped between the pipe and the pipe contact surface of the unset slip segments;

Figure 6 is a plan view, partially in section, taken along line 6-6 of Figure 5;

Figure 7 is an elevation, partially in cross section, illustrating the present invention as employed to clamp two control lines to a pipe string;

Figure 8 is an elevation, partially in cross section, illustrating details in a control line feed guide of the present invention supplying a control line to a pipe string below a rig floor;

Figure 9 is an elevation, partially in cross section, illustrating the present invention retaining a pipe string from the rig floor in preparation to the addition of a new joint to the pipe string;

Figure 10 is a plan view of a pipe holding assembly of the present invention;

Figure 11 is a bottom view of the pipe holding assembly of Figure 10; and

Figure 12 is a plan view, partially in cross section, illustrating a modified form of the present invention.

Description of the Illustrated Embodiments

Figure 1 of the drawings illustrates a drill ship 10 completing an offshore well 11 by installing a production tubing string 12 into the well. A control line 13, clamped to the production tubing string 12, extends with the production string down to the well 11 through a drilling rig floor 14 of the ship 10. A drilling rig mast 15 extending above the rig floor is used to raise and lower the string 12 with a vertically movable elevator 16 supported from a traveling block or top drive.

The procedure for installing the production string 12 and control line 13 into the well 11 requires that the string 12 initially be supported from the rig floor 14 while the string is lengthened by the addition of pipe sections. Once the pipe sections have been added into the string, the pipe string support is transferred from the floor 14 to the elevator 16 and then is lowered into the well. The manipulation of the pipe support mechanism or structure used to support the string 12 from the rig floor 14 is responsible

for a large percentage of the damage done to the control line 13 during installation of the production tubing. The damage typically occurs when the control line is pinched between the tubing string and the pipe support structure used to support the string from the rig floor.

Figure 2 of the drawings illustrates a conventional prior art completion technique in which a control line 17 is secured with a clamp 18 to a production tubing string 19 above a rig floor 20. During the installation process, the control line 17, clamp 18 and production tubing 19 are received within and are lowered through a pipe support structure 21 supported by the rig floor 20. The prior art process requires that the control line extend through the same structure 21 used to support the pipe string 19 on the rig floor. When the control line and the pipe support mechanism occupy the same space at the same time, an opportunity arises for crimping the control line with the pipe support equipment.

Figure 3 and Figure 4 illustrate a convention slip assembly (spider), indicated generally at 23, used to support a pipe string 24 from a rig floor 25. The slip assembly 23 is illustrated resting on the rig floor 25, centrally positioned about a rig floor opening 26. Slip segments 27 are illustrated received within a frustro-conical bowl 29 in gripping engagement with the pipe string 24. The slip assembly 23 operates conventionally to exert a radial gripping force against the pipe string 24 that holds the string stationary and prevents it from falling through the rig floor. The gripping force is created by the wedging action of the tapered slip segments 27 being pulled downwardly into the frustro-conical bowl. The downward pull on the tapered slip segments is produced by the weight of the tubing string acting through the fictional engagement of the slip segments with the pipe string.

With joint reference to Figures 3, 4 and 5, the conventional method for clamping a control line 29 to the pipe string 24 requires that the control line be positioned in a gap 30 between the set slip segments 27. The slip segments, which are lowered into engagement with the pipe through operation of fluid powered cylinders 31, are operated from a control console that is typically located a few feet away from the slip assembly 23. The person manipulating the console controls must usually rely on a signal from a person positioning the control line in the gap 30. Mistakes made during this communication process can

lead to setting or closing of the slips segments when the control line is not in the gap 30. Figures 5 and 6 illustrate the control line 29 being positioned between a slip segment 27 and the pipe 24. If the slips 23 are set with the control line in the contact area between the pipe 24 and the slip segment 27, the line may be cut, crimped or otherwise seriously damaged.

The system, method and apparatus of the present invention are indicated generally at 50 in Figure 7. A pipe string, indicated generally 52, is illustrated extending through a rotary opening 54 in a rig floor 56 into a well 58. It will be understood that where the well is an offshore well, the floor 56 will be part of a drilling structure such as a buoyant drilling vessel or a jack up rig or a permanent platform structure supported from the water bottom. The well 58 will be understood to be the top of a blowout preventer stack, a riser or conductor pipe, or other tubular assembly that extends downwardly into a bore formed in the earth.

Two control lines 60 and 62 extend respectively from supply reels 64 and 66 resting on the rig floor 56. The structure and operation of the present invention as used in the installation of the two lines 60 and 62 is similar and the following detailed description will be made primarily with reference to the installation of only the line 62. The line 62 extends from the reel 66 to a control line feed guide indicated generally at 70. The guide 70 redirects the control line 62 coming from the reel 66 through the base of a pipe holding assembly, indicated generally at 74, toward alignment with the outside of the pipe string 52.

The pipe string 52 is illustrated suspended by a set of elevator's 76 that in turn is supported by elevator bales 78 and 80. The elevator bales are suspended from a traveling block or top drive (not illustrated) of the rig.

A control line clamp 82 extends around the pipe string 52 over a coupling 52a to secure the lines 60 and 62 firmly against the pipe string 52. The coupling 50 connects together the threaded lower end of a pipe joint 52b with the threaded upper end of a pipe joint 52c. It will be understood that the string 52 is formed by multiple such joint connections. In a preferred application, a clamp 82 is applied to each such connection in the pipe string to secure the control lines 60 and 62 along the entire string length.

Figure 8 illustrates the apparatus of the present invention with the pipe holding assembly 74 resting on the rig floor 56 and having its base extending through the floor opening 54. Only a single feed guide 70 is illustrated in Figure 8. It will be understood that additional feed guides such as the guide 70 may be connected with the pipe holding assembly 74 as desired to accommodate multiple lines approaching the pipe string 52 from two or more directions. The pipe holding assembly 74 is illustrated connected to the elevator 76 by links 84 and 86. The links 84 and 86 may take the form of steel cables or other suitable linking devices that preferably permit limited relative movement between the elevator and the pipe holding assembly 74 after the links have connected the two components. By way of example rather than limitation, the links may be lengths of chain, metal bars with bending or sliding connections, piston-cylinder devices or other suitable means. One end of each of the links 84 and 86 may be provided with a hook or other suitable quick connect /quick release attachment device to facilitate the engagement and release of the connection between the elevator and the spider. Automatic systems for remotely engaging or releasing the connection between the elevator and spider may also be employed. The links 84 and 86 combined with the lifting motion provided by the traveling block or top drive may be considered one form of a linking structure.

The feed guide 70 is equipped with plastic rollers 88, 90, 92 and 94 mounted on a flat, flexible spring arm 100. The arm 100 may be constructed of steel or other suitable material. The lower portion of the spring arm 100 is welded or otherwise suitably affixed to the pipe holding assembly 74. Each of the rollers is mounted on a removable, central steel axel pin, such as a pin 102 in the roller 92, between standoffs secured to the spring arm 100.

The feed guide 70 forms a resilient, confined passage defined by the rollers, standoffs and the spring arm to direct the travel path and bending radius of the control line 60. A specially configured guide plate 103 is formed at the base of the spring arm 100 to protect the control line from abrasion caused by contact with the surrounding components of the pipe holding assembly 74 and rig floor 56.

Figure 9 illustrates the pipe holding assembly 74 in a preliminary phase of the control line installation operation supporting the pipe string 52 from the rig floor 56. The

elevator (not visible) has been detached from the assembly 74 and raised into the derrick in anticipation of the addition of the joint 52b to the joint 52c in the top of the string 52.

With joint reference to Figures 9, 10 and 11, the pipe holding assembly 74 is seen to include primary lifting pad eyes 106 and 108 used for attachment to the elevator. Auxiliary pad eyes such as a pad eye 110 may be positioned at desired circumferential points about the assembly 74 to permit the assembly to be rotated relative to the elevator to any orientation on the rig floor. This flexibility enables the control line feed guides of the pipe holding assembly to be oriented as desired to best receive lines from the supply line reels.

The assembly 74 has a base plate 111 having lateral dimensions that exceed those of the floor opening 54 to permit the assembly to rest over the floor opening. Centering guide plates 112, 114, 116, 118, 120 and 122 extend from the base of the pipe holding assembly 74. The guide plates have inclined, centrally directed surfaces, such as 118a, to center the assembly in the rotary opening as the assembly is being lowered back into position on the floor. Plate surfaces 118b prevent lateral movement of the assembly when it is resting over the floor opening.

The assembly 74 includes a spider section 123 having slip segments 124, 126, 128 and 130 that are movable into and out of holding engagement with the pipe to selectively hold or release the pipe for vertical movement relative to the pipe holding assembly 74. A removable gate 132 permits the spider section to be removed latterly from surrounding relationship with the pipe string. The baseplate 111, which is a bolted or otherwise removably secured to the spider section 123, is provided with a slot 134 that extends from the outside edge of the plate to a central opening 136 in the plate to permit the baseplate to be removed latterly from surrounding relationship with the pipe string. The slot 134 and a symmetrically disposed recess 136 on the opposite end of the plate provide openings for entry of the control lines into the area below the pipe holding assembly to provide access to the pipe string.

In operation, with initial reference to Figure 9, adding a pipe joint 52b to the string's uppermost joint 52c lengthens a string of pipe 52 supported from the floor 54 of a rig. The pipe joint 52b is screwed into a coupling 52d at the top of the joint 52c with

hydraulic power tongs T, in a customary fashion. Once the joint 52b is made up into the top of the pipe string, the elevator 76 is latched about the top end of the joint 52b and raised slightly to raise the string 52, allowing the pipe holding assembly 74 to release the pipe string.

With the pipe holding assembly 74 open so that it is no longer engaging the pipe, the elevator and attached string are lowered into the position illustrated in Figure 8. During this lowering process, the control line 62, which is already attached to the pipe string 52, spools off of the reel 66 as it follows the lowering pipe string. As the control line feeds off the reel, the feed guide 70 directs the control line position and path of movement to prevent abrasion or over bending and to maintain the control lines adjacent the pipe string.

With the elevator 76 near the pipe holding assembly 74, the flexible links 84 and 86 are connected to the pipe holding assembly 74. The elevator is lowered toward the pipe holding assembly 74 until the links 84 and 86 become slack and the elevator is set to engage the pipe. The elevator is then raised to take over the string support from the pipe support assembly 74. The slack connection between the elevator and pipe holding assembly permits sufficient relative motion between the elevator and pipe holding assembly to permit the elevator to set and lift the string 52 before the slack is removed from the links. The pipe holding assembly slips may be opened after the pipe is supported in the elevator 76 to permit the elevator to be raised so that the pipe holding assembly is lifted from the floor and suspended from the flexible links 84 and 86.

Once the pipe holding assembly 74 is suspended from the flexible links 84 and 86, the spider slips are closed so that the assembly 74 remains fixed relative to the pipe string 52. By thus engaging the pipe holding assembly with the pipe, the assembly is prevented from shifting off center in response to the sidewise forces imposed through the guide 70.

From the position illustrated in Figure 8, the elevator 76 and attached pipe string 52 and pipe holding assembly 74 are raised to the position illustrated in Figure 7. During this raising process, the control line 62 is spooled off of the reel as it follows the rising string. While the line 62 is feeding off the reel to follow the rising pipe, it does not travel through the guide 70. The spring action of the guide 70 and the confined path formed by

the arm 100 and the guide rollers prevent the line 62 from bending too sharply during the string raising process.

With the pipe string in the position illustrated in Figure 7, the clamp 82 is placed around the pipe string coupling 52a and the control line 62 and bolted or otherwise secured in place. The elevator 76 and attached string 52 and pipe holding assembly 74 are then lowered back to the position illustrated in Figure 8. When the pipe holding assembly 74 is properly positioned within the floor opening 54 and resting on the floor 56, the spider slip segments 124, 126, 128 and 130 are moved into position against the pipe and the string is then lowered slightly to cause the slips to firmly set against the pipe. Once the pipe holding assembly 74 supports the weight of the string 52, the flexible links 84 and 86 are released from the pipe holding assembly to permit the elevator to release the pipe and be returned up into the derrick. Thereafter the previously described process may be repeated to add another joint of pipe to the string and to clamp control lines to the added pipe.

If desired, two or more joints of pipe may be added to the string before the string is raised back up into the derrick to permit two or more clamps to be applied to the couplings without intermediate raising and lowering steps.

If it becomes necessary to remove the pipe holding assembly 54 from the pipe string 52 without lifting the assembly over the top of the pipe string, the spider section 123 is unbolted or otherwise released from the base plate 111. The gate 132 is then removed to allow the spider section to be pulled latterly away from the pipe 52. The plate 111 may then be latterly removed by pulling the plate away so that the pipe passes through the plate slot 134. The guide 70 is released from the control line 62 by removing the rollers 88, 90, 92 and 94. Placement of the assembly 74 about the pipe string is accomplished by reversing the previously described procedure.

Figure 12 illustrates a modified form of the invention, indicated generally at 150. The construction and operation of the embodiment of Figure 12 is similar to that described with reference to Figures 7 through 11. Similar or corresponding components bear the same reference characters in the drawings. The embodiment 150 includes an

insert bowl 152 disposed in a conventional rotary bushing 154. The bushing 154 is set in the floor 56 of the rig.

The insert bowl 152 has been provided with recesses 158 and 160 that increase the opening into the area between the pipe holding assembly and the floor 56. Suitable feed guides such as the feed guide 70 may be connected with the assembly 74 as previously described to assist in protecting and directing movement of the control lines into the area below the assembly 74.

The insert bowl 152 may be a conventional, American Petroleum Institute (API) insert bowl. A preferred form of the invention employs a conventional API split insert bowl that is received within a conventional rotary bushing in a drilling rig floor. In addition to providing additional space for entry of the control lines, the API bowl can accept standard API slip assemblies that may be used to support the pipe string, if necessary, during the installation of the control lines.

While certain preferred embodiments of the present invention have been described herein in detail, it will be appreciated that various changes in the function, construction and operation of the invention may be made without departing from the scope and spirit of such invention. By way of example rather than limitation, while the invention has been described for use on a rig floor, it may equally well be used on any structure designed to selectively support and move a pipe string that is being installed in a location below a support surface of the structure. In such an application, the support structure would correspond to the rig floor referred to in the description of the invention. Thus, as used herein, the term "floor" is intended to include any support structure used to support the pipe holding device while the weight of the string is being carried by such pipe holding device. Other modifications include the use of the invention with the spider being "flush mounted" so that the top of the spider is at about the same level as the floor. Similarly, while the device used to impart vertical movement to the string has been identified as a traveling block or top drive, other suitable mechanisms such as the traveling head of a snubber or other device may be employed without departing from the invention. It will also be understood that the term "drilling rig" or "rig" is not intended to be limited to a conventional drilling or completion rig having a mast, floor, rotary table,

traveling block or top drive. Rather, the term "rig" is intended to encompass any structure having the capability of installing and/or retrieving a tubular body into or from a location below the structure. Further by way of illustration, while the present invention has at times been described with reference to a "production pipe string" or a "production tubing string", the invention has applicability to any string of pipe being installed below a support structure.

A modified form of the invention may employ a linking structure comprising an extendable/retractable fluid rod/cylinder assembly to raise or lower the spider which the elevator remains stationary. In such a modification, the rod/cylinder assemblies are carried by the elevator and are attached to the spider when actuated to retract, the assemblies raise the open spider above the coupling of the just added pipe section to permit the control lines to be clamped to the pipe. Extension of the rod/cylinder assembly places the spider back on the floor where it may be released from the two assemblies, permitting the two assemblies to retract to permit lowering of the attached pipe string. The spider is thereafter closed on the pipe to support the string and the next pipe section is added. The described process is repeated as pipe is added to the string. In similar fashion, rod/cylinder assemblies mounted on the rig floor may act as the linking structures to raise and lower the spider as required to provide access below the spider for clamping control lines.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof, and it will appreciated by those skilled in the art, that various changes in the operation, location, and architecture as well as in the details of the illustrated embodiments or combinations of features of the elements/steps may be made without departing from the spirit of the invention.